ALL WHEEL DRIVE CONTINUOUSLY VARIABLE TRANSMISSION HAVING DUAL MODE OPERATION

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to automatic transmissions for automotive vehicles. More particularly it pertains to such transmissions having a fixed ratio drive mechanism and a variable ratio drive mechanism.

2. Description of the Prior Art

A conventional multiple speed transmission has a number of spaced speed ratio changes produced by selectively holding and releasing components of a planetary gear set. An infinitely variable transmission that employs two variable diameter pulleys, and a drive belt engaging the pulleys provides a continuously variable speed ratio over a broad range of engine speeds.

A bladed hydrokinetic torque converter located in the drive path between an engine and the planetary gearing provides additional torque multiplication for accelerating a motor vehicle from rest. A stall torque ratio of about 2.5:1 may be realized using a torque converter.

A continuously variable transmission combining a fixed drive unit, variable drive unit, and torque converter is described in UK Patent application GB-2180020, assigned to the assignee of the present invention. After the torque converter reaches its coupling phase, when the ratio of the hydrokinetic unit is 1:1, the drive ratio for the powertrain is reduced to 8:1 from approximately 20:1 when the fixed drive ratio is 2:1 and the final drive and axle system ratio is 4:1. At that time the variable ratio drive is activated. Upon further acceleration of the vehicle, the overall transmission ratio may be controlled from 8:1 down to 2:1.

U.S. Pat. Nos. 4,856,369, 4,836,049 and 3,203,277 describe continually variable transmissions that employ a variable drive mechanism and a fixed drive mechanism in combination with a torque converter and planetary gearing.

SUMMARY OF THE INVENTION

It is an object of this invention to provide a transmission able to accelerate a motor vehicle from rest through a speed reduction drive that bypasses a belt driven variable ratio drive mechanism so that the relatively large starting torque is carried by robust mechanical components and not by torque limited components, such as a drive belt.

It is another object of this invention that the transmission produce a continuously variable speed ratio over a range from the first gear (starting gear) ratio to the highest ratio, an overdrive ratio.

It is yet another object of the invention to provide a transmission able to drive both front and rear wheels from two output shafts and without need for a transfer case to divide output torque carried on a single output shaft and to transmit torque to front and rear driveshafts.

According to the invention a continuously variable transmission for an automotive vehicle includes an input shaft; an intermediate shaft; an output shaft; a variable ratio drive mechanism having an input, an output driveably connected to said input and intermediate shaft, and an endless belt driveably engaged with the input and output for producing a continuously variable ratio of the input speed to the output speed; fixed ratio drive mechanism having an first element driveably connected to the output shaft drive and a second element driveably connected to the intermediate shaft; a first gearset having an input driveably connected to the input shaft and an output, for driving the output at a slower speed than the speed of the input; a second gearset having an input driveably connected to the output of the first gearset and an output driveably engaged with said input, for producing a slower speed and opposite direction of rotation of the output relative to the speed and direction of the input; a transfer clutch for alternately driveably connecting and disconnecting the input of the variable ratio drive mechanism and input shaft; an overrunning clutch producing a one-way drive connection of the output of the second gearset and the output shaft; and a low brake for alternately driveably holding fixed against rotation and releasing an element of the first gearset whereby the output of the first gearset is driven at a slower speed than the speed of the input shaft. Torque to the front axle is delivered by a second output shaft; and a clutch for alternately driveably connecting and disconnecting the intermediate shaft and second output shaft.

A reverse drive feature of the invention further includes a first reverse clutch for alternately driveably connecting and releasing the input shaft, output of the first gearset and the input of the second gearset; and a second reverse clutch for alternately driveably connecting and disconnecting the gear of the second gearset and the output shaft.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic diagram of the kinematic arrangement for an automatic transmission according to the present invention.

FIG. **2** is a chart showing the engaged and disengaged state of clutches and brakes of the transmission of FIG. **1**.

FIG. **3** shows a second embodiment of the reverse clutch shown in FIG. **1**.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring first to FIG. **1**, a continuously variable transmission according to this invention includes an input shaft **12**, rear output shaft **14**, front output shaft **15**, variable ratio drive mechanism **16**, fixed ratio drive mechanism **18**, layshaft gearing **20**, planetary gearset **22**, and various clutches and brakes for controlling the mechanical elements of the transmission.

Fixed ratio drive mechanism **18** driveably connects output shaft **14**, which rotatably supports a first sprocket wheel **24**, and intermediate shaft **26**, which supports a second sprocket wheel **28**, sprockets **24**, **28** being mutually driveably engaged through a chain **30**. Alternatively, shaft **26** can be driveably connected to shaft **14** through another fixed ratio gear mechanism, such as a simple layshaft arrangement including gears in place of sprockets **24**, **28** and an idler gear meshing with those gears so that shaft **26** turns in the same direction as shaft **14**. The first sprocket **24** is fixed to and rotatably supported on shaft **14**; the second sprocket **28** is fixed to and rotatably supported on intermediate shaft **26**.

The engine crankshaft **40** is driveably connected to a hydrokinetic torque converter **46** that includes a bladed impeller wheel **42** arranged in a toroidal fluid flow path with a bladed turbine wheel **44**, arranged to be driven hydrodynamically by fluid exiting the impeller wheel. A bladed stator wheel **48** is located in the flow path between fluid entrance to the impeller and the fluid exit of the turbine. A one-way clutch **50** rotatably supports the stator wheel in one direction about the axis of shaft **12**. In a conventional way the torus of the torque converter is filled with hydraulic fluid